

Norfolk, in which county they remodelled most of the then existing decoys and constructed others. Descendants of the same family, having since removed to other counties, are some of them still celebrated for the skill with which they exercise the talent inherited from their forefathers. When "Old George Skelton" first came into Norfolk he found the decoy-pipes simply grouped around the margins of the "Broads," a plan which did not at all accord with his ideas of propriety, the great extent of water rendering it difficult if not impossible to have the fowl under what he considered proper control. He therefore selected a small piece of water of about two acres in extent on the banks of which to construct his decoy, much to the amusement of the local decoymen; but their derision was soon changed to amazement when in one week he captured 1100 teal in his "two-acre puddle" as they derisively termed it. The son of this man, also known as "Old George Skelton," was equally celebrated for his skill as a decoyman, and left his mark upon many of the Norfolk decoys. This man, says Sir Ralph Gallwey, is described as a "very peculiar man, short of stature, web-footed like a duck, very strongly built, particularly kind in disposition, perfectly indifferent to cold and hardship, well-informed, and unequalled in skill in the construction and management of decoys."

In the space at our disposal it would be impossible even to epitomise the full and elaborate instructions for erecting and working a decoy given so clearly and precisely that the thirty-two plans and illustrations are scarcely necessary for their elucidation. But with such assistance there should be no difficulty in erecting the decoy, and by following the ample instructions experience would be gained in a season or two sufficient to enable almost any one to work the pipes with tolerable success; but the art of decoying is only to be acquired in perfection by careful and continued study of the habits of the frequenters of the decoy pond with practice added. We quite agree with Sir Ralph Gallwey that there cannot be a more interesting adjunct to an estate than a duck decoy, if even it be only worked on occasions to obtain a supply of fowl for the table of the proprietor and as acceptable presents to his friends; but should he be a naturalist and fond of the study of birds, a peep through the screen of his decoy at the fowl disporting themselves in a state of perfect unconsciousness under his very eye and almost within his grasp will go far towards repaying him the trifling outlay the decoy will entail. Nor need the fact of the decoy being worked preclude the proprietor from the occasional use of the gun: if not persistently disturbed the fowl will speedily return, and although it is undoubtedly to the advantage of the decoy to be perfectly secluded, a very successfully worked decoy is known to the writer in so exposed a situation that the fowl on the water may be seen from a public road which passes close by; it is astonishing how soon wildfowl become accustomed to sounds and sights which are not sudden or unexpected.

Sir Ralph Gallwey enumerates forty-four working decoys, and traces with more or less success the history of 149 others which have ceased to be used in England, and three active and nineteen disused decoys in Scotland; the sister island, so far as he can ascertain, never having possessed a decoy. Of this large number Lincolnshire

possessed thirty-nine, only one of which is still worked; Essex thirty, three of which are still worked; Norfolk twenty-six, with five still worked; and Yorkshire fourteen, with two only still in use. The history of these decoys as given by Sir Ralph Gallwey will be found replete with antiquarian interest as well as with abundant matter for the consideration of the naturalist, and his chapter on the Lincolnshire Fens is especially interesting.

A short account is given of the decoys existing in Holland, from which country enormous numbers of fowl are exported annually, and which probably indicates the state of affairs which existed in this country in the palmy days of the duck decoy. A small woodcut on p. 200 shows a form of nesting basket used by the Dutch for their tame decoy ducks, and which would probably prove an excellent contrivance for inducing wild birds to nest in our own shrubberies and pleasure-grounds.

We cannot speak too highly of the plates and plans with which this handsome volume is illustrated, and we cordially recommend it to the perusal of all lovers of field-sports.

#### COMETARY AND PLANETARY ORBITS

*Traité de la Détermination des Orbites des Comètes et des Planètes.* Par le Chevalier Théodore d'Oppölzer, &c. Édition Française. Par Ernest Pasquier. (Paris: Gauthier-Villars, 1886.)

THIS is a translation from the second edition of the first volume of Prof. Oppölzer's laborious and truly classical work in German, on the theory and practical determination of the orbits of comets and planets. It has been made with the full assent and co-operation of the author, and with the assistance of Dr. Schram and others who greatly aided in the production of the original work. The volume comprises nearly 500 pages of text and 200 pages of tables, and is an excellent specimen of typography throughout. Oppölzer's first volume is divided into two parts, the first termed *preparatory*, the second treating of the determination of orbits in the various conic sections. In the preparatory part we have chapters on the transformation of co-ordinates; on co-ordinates in their relation to the time and the relation between the position of the celestial body in its orbit and the corresponding epoch; likewise on the relation between a number of positions in the orbit. There is a chapter on aberration, and an important one on the theoretical determination of the formulæ of precession and nutation. The second part commences with the treatment of parabolic orbits, of which the numerous cometary discoveries of the present day necessitate so frequent application, and there are fully-worked numerical examples referring to the comets 1869 III. and 1881 III. This section is followed by a chapter, which will have much interest, on the determination of the orbit of a swarm of meteors by means of its radiant point, a problem which is reduced within a very small expenditure of time and calculation: a numerical example is worked out for one of Prof. Weiss's radiants. The next section treats of the calculation of the orbit where no assumption is made with respect to the excentricity: (1) from three observations only, as is more usually the case; (2) where four observations are introduced. The well-known general method of Gauss was published early in the present

century, and has been used in determining the orbits of a large number of the minor planets, and of the comets of short period. Oppölzer substitutes for it in his second edition one of his own, which, from extensive application he has found to be much superior to all other methods, both as regards the precision of the results and the rapidity with which the computations may be performed. In the case of the planet *Ceres* he obtained results on a first approximation more exact than those given by the method of Gauss after three approximations. Further, it is pointed out that, where four observations are employed, Gauss's method is not applicable, except when the excentricity is small. There is a chapter on the modifications of Oppölzer's method necessary in the determination of cometary orbits; also a numerical example for the orbit of the minor planet *Eudora*, and one for the first comet of 1866, or the comet of the November meteors, as well as a comparison of the new method with that of Gauss, by an example taken from the *Theoria motus*. So far, three observations are employed. Similar examples follow for the case of four observations. A succeeding section deals with the calculation of circular orbits, and it is shown that an ephemeris deduced from a circular orbit, which admits of comparatively rapid and easy calculation, may be made of service in following for a time a newly-discovered minor planet. In an appendix are collected all the formulæ usually required in the first determinations of orbits, with reference to those parts of the volume where the analysis and other details are to be found—a *résumé* that possesses great value in so extensive a work. The tables which follow are on a greatly extended and refined system, more especially that for the calculation of the true anomaly in the parabola.

The great work of Oppölzer, of which Prof. Pasquier has presented astronomers with so admirable a translation, is not one suited to a beginner; but the student with a certain knowledge of the differential and integral calculus, and of analytical mechanics, may initiate himself with its aid, as the translator remarks in his preface, "à l'un des problèmes les plus hardis que se soit posés l'intelligence humaine."

#### LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

#### The Silver-Blue Cloudlets again

FROM your last week's issue, p. 264, it would seem that the silver-blue clouds and cloudlets seen at midnight low down over the northern horizon both in this, and last, year's July are attracting much attention among your correspondents; but have not yet had the spectroscope directed to them.

Now there was a remarkable display of those bright blue clouds on the night of Tuesday, July 27, though with some variations on their exact mode of appearance in the *earlier* part of the month; but not necessarily removing them into a different category. The day had been cold but clear, especially in the northern direction, from which the wind was blowing, bar. =

29.60, night temp. = 48° F., depression of wet-bulb = 4° 0 F. It was therefore just such a night as at this season of the year and in this high latitude is certain to show a coloured twilight over the sun's place beneath the northern horizon, if ordinary thick fogs, and low cloud-banks do not interfere.

On issuing, then, that night, close upon twelve o'clock, from the Observatory computing-room, upon the Calton Hill, I was surprised and even startled, not at seeing a low-down coloured twilight in the north, but at the excessive strength, and glittering brightness of its colours. You might indeed have, at first sight, imagined that some great city, spread abroad over the plains of Fife was in a fierce state of extensive conflagration, so burning red was the first and lowest stratum extending along nearly 20° of the horizon. But that awful kind of redness passed quickly into lemon-yellow clouds in the stratum next above the red; and then came the silver-blue cloudlets just above the lemon-yellow, and even brighter still; but with an innocence of colour and gentleness of beauty, which at once exorcised the horrid idea of malignant flames devouring the works of man; and showed it must be something very different.

But still what was it, that made that low level strip far away in the north, just then so brilliant in its light and intense in its colours,—that it, and it alone seemed for the time, to be illumining the otherwise pitchy darkness of night? At the same time a few stars were faintly visible; while a long streamer, of apparently white cirrus cloud, trailed over half the sky from west, to east-north-east, and passed across the Polar region at a considerable altitude, having the silver-blue cloudlets and their gorgeous red basement far below, but within, its wide-inclosing sweep.

On reaching home, I got a large spectroscope to bear on the brightest part of the low level streak of richly coloured light, its red, and yellow, and light blue, both collectively, and separately; but with no other decided effect than a short continuous spectrum in the green; which, as I have elsewhere long ago shown, is the spectrum of ordinary twilight always. For even though red and yellow be present to the eye at large, these colours rapidly fade out in any slit-formed spectrum, leaving the maximum of faint twilight placed by the prism as above described.

On this occasion, however, I did remark that that short continuous spectrum began in its citron, or commencing, region rather abruptly: in fact I even imagined a bright line there; and after several independent measures of spectrum-place, duly tested by reference both to a hydrogen tube, and the micrometer readings,—made out, that it was in the very position of the aurora line; or that, in fact, aurora was at that moment assisting, though to a very small extent, in that low streak of merely, but yet so intensely coloured, solar and Scottish, midsummer-midnight, northern, twilight.

Going next to the window, with a hand spectroscope, and examining the long ribbon of supposed white cirrus at some immense elevation,—it was startling as well as delightful to find it to consist of hardly anything but aurora; and to see aurora's chief line thin, sharp and positively brilliant along its whole extent; even appearing, if that could be, several times brighter, than its parent white streamer itself looked to the naked eye.

Nor did the identification, as aurora, of this fair white arc (transverse to a line leading to the magnetic pole), depend on the spectroscope alone: for, about 1 a.m., it began to form luminous, and rather yellowish, abutments to both its western and eastern terminations. Then its original singleness of curvature began to mould itself in the north-west into several curves of shorter radius; and after that, many thin arrows and shafts of light began to shoot out at right-angles from some parts of the great arc, and towards the zenith; and then, after a few minutes, died away. In fact it was to the eye a very fair auroral display, though the papers next morning said nothing about it.

But luminous manifestations were by no means the whole of what the aurora was doing; for presently I could conceal from myself no longer that the whole space below that long and high vaulting, white, upper arc was darkened, as compared against the sky elsewhere, with a brown-black hue; which moreover darkened still further and deepened in obscurity as it descended, until it suddenly ended sharply above, and quite close to, the silver-blue cloudlets of the low coloured twilight on the northern horizon.

Here then was a key at once to the apparently supernatural brilliance of the silver-blue cloudlets and the other colours below them; viz., all the broad expanse of ordinary further,